FORM PTO-1390 (REV 10-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER: 6640/59442

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

472 Rec'd PCT/PTO 10 APR 2000

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/529269

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP99/04377	August 12, 1999	August 13, 1998

TITLE OF INVENTION: Acoustic Apparatus and Headphone

APPLICANT(S) FOR DO/EO/US: Kensaku Abe, Kazuhisa Kito, Hirofumi Nishimoto, and Keiko Yabuki

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendemnts has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information:

    1.) Formal Drawings
    2.) International Search Report
    3.) Verification of Translation

(January 1996)

422 Rec'd PCT/PTO 10 APR 2000

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/529269	PCT/JP99/04377	6640/59442

17. ☐ The following fees are submitted:	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):	
Search Report has been prepared by the EPO or JPO ..... $ 840.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... $	
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... $	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... $	
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	15 - 20 =		X	$
Independent claims	7 - 3 =	4	X 78.00	$ 312.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $	$
	TOTAL OF ABOVE CALCULATIONS =			$ 312.00
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28).				$
	SUBTOTAL =			$
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$
	TOTAL NATIONAL FEE =			$
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$
	TOTAL FEES ENCLOSED =			$ 1,152.00
				Amount to be: refunded $
				charged $

a. ☒ A check in the amount of $ 1,152.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-3125. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO

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Jay H. Maioli
SIGNATURE

Jay H. Maioli
NAME

27,213
REGISTRATION NUMBER

6640/59442

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Kensaku Abe et al.

Serial No.: 09/529,269

Filed : April 10, 2000

For : ACOUSTIC APPARATUS AND HEADPHONE

Group A.U.:

I hereby certify that this paper is being deposited this date with the U.S. Postal Service in first class mail addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.

May 26, 2000
Jay H. Maioli Date
Reg. No. 27,213

May 26, 2000
1185 Avenue of the Americas
New York, NY 10036
(212) 278-0400

PRELIMINARY AMENDMENT

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Prior to the initial examination of the above-identified application, Applicants respectfully request that the application be amended as follows.

IN THE SPECIFICATION

Page 1, line 24, change "And the" to --The--.

Page 2, line 3, change "characteristics", both

6640/59442

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Group A.U.:

I hereby certify that this paper is being deposited this date with the U.S. Postal Service in first class mail addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.

May 22, 2000
Jay H. Maioli Date
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May 22, 2000
1185 Avenue of the Americas
New York, NY 10036
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PRELIMINARY AMENDMENT

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

Prior to the initial examination of the above-identified application, Applicants respectfully request that the application be amended as follows.

IN THE SPECIFICATION

Page 1, line 24, change "And the" to --The--.

Page 2, line 3, change "characteristics", both occurrences, to --characteristic--.

Page 3, line 1, change "collect" to --collects--;

line 3, change "And the" to --The--;

line 4, change "is" to --are--.

Page 4, line 25, change "to the" to --on a--.

Page 6, line 3, change "is" to --are--;

line 8, delete "can";

same line, after "adjustment" insert --can--;

line 11, change "is" to --are--.

Page 8, lines 13-14, change "And inserting" to --Inserting--.

Page 10, line 14, delete "to achieve".

Page 12, line 25, change "hear" to --hears--.

Page 13, line 7, change "hear" to --hears--;

line 11, change "hear" to --hears--;

line 19, change "And in" to --In--.

Page 16, line 19, change "recording" to --recorded--.

Page 17, line 6, after "of" insert --an--.

Page 18, line 21, change "invention' to --device--.

IN THE ABSTRACT OF THE DISCLOSURE

Line 3, change "with an" to --which--;

line 5, change "comprises" to --includes--.

IN THE CLAIMS

Please amend claims 1-15 by rewriting same to read as follows.

--1. (Amended) An acoustic apparatus comprising:

a headphone section [to be] mounted on [the] a user head, having [the] a microphone element for detecting [a] sound around the user and a signal acoustic transducing element [with a function] functioning as a sound source for canceling the sound around the user, housed in a headphone box, [and equipped] with a first output terminal for outputting [the] a microphone audio signal collected by the microphone element and a first input terminal for inputting [the] a cancel audio signal supplied to the signal acoustic transducing element[,]; and

a control circuit section independent from the headphone section, [equipped] with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and [intended to control] controlling at least [the] frequency characteristics and [the] gain characteristics of the microphone audio signal from the microphone element of the headphone section [inputted] input through the second input terminal, to generate [a] the cancel audio signal [that can serve as a sound source] for canceling the [surrounding] sound around the user, and [to supply] supplying the cancel audio signal to the signal acoustic transducing element of the headphone section through the second output terminal.

--2. (Amended) [An] The acoustic apparatus according to claim 1, wherein the control circuit section [is equipped with a] further comprises recording means for recording the microphone audio signal from the microphone element.

--3. (Amended) [An] The acoustic apparatus according to claim 1, wherein the control circuit section [is equipped

with] further comprises:

means for adding different audio signals to the [canceling] cancel audio [signals by] signal using [the] a signal audio converter element as a sound source [in order to cancel] for canceling the [surrounding] sound around the user.

--4. (Amended) [An] The acoustic apparatus according to claim 1, wherein the control circuit section further comprises:

[a] means for adding different audio signals to the [canceling] cancel audio [signals by] signal using [the] a signal audio converter element as a sound source [in order to cancel] for canceling the [surrounding] sound[,] around the user; and

a remote control [equipment is] configured [so as] to supply remote-control signals for remotely controlling [the] output [device] of the different audio signals [to the] from an output device of the different audio signals.

--5. (Amended) An acoustic apparatus comprising:

a headphone section [to be] mounted [to the] on a user head, having [the] a microphone element for detecting sound around the

user and a signal acoustic transducing element [with a function] functioning as a sound source for canceling the sound around the user, housed in a headphone box, [and equipped] with a first output terminal [equipped] with an adjusting section for adjusting [the] an output of [the] a microphone audio signal collected by the microphone element and a first input terminal for inputting [the] a cancel audio signal supplied to the signal acoustic transducing element, and

a control circuit section independent from the headphone section, [equipped] with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and [intended to control] controlling at least [the] frequency characteristics and [the] gain characteristics of the microphone audio signal from the microphone element of the headphone section [inputted] input through the second input terminal, to generate [a] the cancel audio signal that can serve as a sound source for canceling the [surrounding] sound around the user, and [to supply] supplying the cancel audio signal to the signal acoustic transducing element of the headphone section through the second output terminal.

--6. (Amended) [An] The acoustic apparatus according to claim 5, wherein an amplifier section is [equipped] included in the headphone box behind the adjusting [means] section for [generating] amplifying the [output] microphone audio signal from the microphone element [serving as a sound source in order to cancel the sound around the user] and for adjusting the [output] microphone audio signal from the microphone element, [and] where gains are controlled by amplifying the [output signals] microphone audio signal.

--7. (Amended) [An] The acoustic apparatus according to claim 5, wherein an amplifier section for [generating] cancel audio signals serving as a sound source for canceling the sound around the user and [an] adjusting means for adjusting [the] an output level of the amplifier section are provided in the headphone box, and gains of the cancel audio signal [signals inputted] input to the signal acoustic transducing element are controlled.

--8. (Amended) [An] The acoustic apparatus according to claim 5, wherein an adjusting section [generates output

signals] adjusts the microphone audio signal from the microphone element that serves as [an] a sound source for canceling the sound around the user and adjusts the [output] microphone audio signal from the microphone element in the headphone box,

said adjusting means having [an] operating means which the user is able to operate from the outside the headphone box, and

an amplifier section for amplifying the [output signals] microphone audio signal adjusted at the adjusting section.

--9. (Amended) An acoustic apparatus [according to the present invention] comprising:

a headphone section [to be] mounted [to the] on a user head, having [the] a microphone element for detecting sound around the user and a signal acoustic transducing element [with a function] functioning as a sound source for canceling the sound around the user, housed in a headphone box, [and equipped] with a first output terminal for outputting [the] a microphone audio signal collected by the microphone element and a first input terminal for inputting [the] a cancel audio signal supplied to the signal acoustic transducing element[,]; and

a control circuit section independent from the headphone

section, [equipped] with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and [intended to control] controlling at least [the] frequency characteristics and [the] gain characteristics of the microphone audio signal from the microphone element of the headphone section [inputted] input through the second input terminal, [the] with said frequency characteristics and gain characteristics being adjusted to achieve [the] a predetermined [ones in the] level at a predetermined frequency between 50 Hz and 1.5 kHz, to generate [a] the cancel audio signal that can [serve as a sound source for canceling] cancel the [surrounding] sound around the user, and [to supply] supplying the cancel audio signal to the signal acoustic transducing element of the headphone section through the second output terminal.

--10. (Amended) An acoustic apparatus [according to the present invention comprises] comprising:

a headphone section [to be] mounted [to the] on a user head, having [the] a microphone element for detecting sound around the user and a signal acoustic transducing element [with a function]

functioning as a sound source for canceling the sound around the user, housed in a headphone box, [and equipped] with a first output terminal for outputting [the] a microphone audio signal collected by the microphone element and a first input terminal for inputting [the] a cancel audio signal supplied to the signal acoustic transducing element[,];

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and [intended to control] controlling at least [the] frequency characteristics and [the] gain characteristics of the microphone audio signal from the microphone element of the headphone section [inputted] input through the second input terminal, to generate [a] the cancel audio signal [that can serve as a sound source] for canceling the [surrounding] sound around the user, and [to supply] supplying the cancel audio signal to the signal acoustic transducing element of the headphone section through the second output terminal[,]; and

[a control circuit section in which the] a circuit configuration for canceling the surrounding sound used by the

control circuit section that is of a feed-forward system.

--11. (Amended) An acoustic apparatus [according to the present invention comprises] comprising:

a headphone section [to be] mounted [to the] on a user head, having [the] a microphone element for detecting sound around the user and a signal acoustic transducing element [with a function] functioning as a sound source for canceling the sound around the user, housed in a headphone box, [and equipped] with a first output terminal for outputting [the] a microphone audio signal collected by the microphone element and a first input terminal for inputting [the] a cancel audio signal supplied to the signal acoustic transducing element[,];

a control circuit section independent from the headphone section, [equipped] with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and [intended to control] controlling at least [the] frequency characteristics and [the] gain characteristics of the microphone audio signal from the microphone element of the headphone section [inputted] input through the second input terminal, to generate [a] the cancel

audio signal [that can serve as a sound source] for canceling the [surrounding] sound around the user, and [to supply] supplying the cancel audio signal to the signal acoustic transducing element of the headphone section through the second terminal[,]; and

[a control circuit section in which the] a circuit configuration for canceling the sound surrounding [sound] the user used by the control circuit section that is of a feedback system.

--12. (Amended) A headphone comprising:

a box for housing a microphone element for detecting [the] sound around [the] a user and a signal acoustic transducing element [equipped with a function] functioning as a sound source for canceling the sound around the user,

an output terminal [of the] for a microphone audio signal whose sound is collected by the microphone element, and an input terminal for a cancel audio [signals] signal supplied to the signal acoustic transducing element.

--13. (Amended) A headphone comprising:

a box for housing a microphone element for detecting [the] sound around [the] a user, a signal acoustic transducing element [equipped with a function] functioning as a sound source for canceling the sound around the user, and an adjusting section for adjusting [the] a cancel amount of the [surrounding] sound[,] around the user; and

an output terminal [of the] for a microphone audio signal whose sound is collected by the microphone element, and an input terminal for a cancel audio [signals] signal supplied to the signal acoustic transducing element.

--14. (Amended) [A] The headphone according to claim 13, wherein the adjusting section comprises [a] means for adjusting gains to [output signals] the microphone audio signal from the microphone element.

--15. (Amended) [A] The headphone according to claim 13, wherein the adjusting section comprises [a] means for adjusting gains to the [signal inputted] cancel audio signal input to the signal acoustic transducing element.--

REMARKS

Claims 1-15 remain in the application having been amended hereby.

As will be noted from the Declaration, Applicants are citizens and residents of Japan and this application originated there.

Accordingly, the amendments made to the specification are provided to place the application in idiomatic English, and the claims are amended to place them in a better condition for examination.

An early and favorable examination on the merits is earnestly solicited.

Respectfully submitted,

COOPER & DUNHAM LLP

Jay H. Maioli
Reg. No. 27,213

JHM/KJB
encl.

DESCRIPTION

ACOUSTIC APPARATUS AND HEADPHONE

TECHNICAL FIELD

The present invention relates to a headphone and acoustic apparatus which reduce noise from the surroundings and make it easier to listen to, for example, music.

BACKGROUND ART

There is known a so-called noise canceling headphone which can reduce noise of the surroundings by collecting noise around the user by a microphone with a headphone incorporated into a housing, analyzing the noise, and outputting a negative phase sound from the signal-audio converter element (hereinafter called the "driver unit") of the headphone.

In this case, as for the noise canceling system, two types are available: a feed-forward system and feedback system. FIG. 9 shows a configuration of the noise canceling headphone of the feed-forward system, while FIG. 10 shows a configuration of the noise canceling headphone of the feedback system.

In the feed-forward system of FIG. 9, the microphone element is arranged at such a location that a noise around the microphone element is collected but a sound released from the driver unit 2 is not collected. And the electric signal from the microphone element 1 corresponding to the surrounding noise

collected is supplied to the equalizer circuit 3.

This equalizer circuit 3 has a phase and amplitude characteristics, that is, a frequency characteristics, optimally designed in order to obtain an audio signal for canceling the surrounding noise inputted. An output signal of the equalizer circuit 3 is supplied to an AMP 5 via an adder circuit 4.

This AMP 5 is optimally designed so that the gain of the audio signal for canceling the sounding noise becomes optimal. The audio signal for canceling the surrounding noise from the AMP 5 is supplied to the driver unit 2. That is, the driver unit 2 functions as a sound source for canceling the surrounding noise of the user.

As described above, the sound of a phase negative to that of the surrounding noise is emitted in the vicinity of user's ears and is acoustically synthesized with the surrounding noise. As a result, the surrounding noise is canceled and the sound with reduced surrounding noise is listened to by the user.

In the case such as this, from an audio signal input terminal 6, music signals, etc. are supplied, added at the adder circuit 4, and supplied to the driver unit 2 via the AMP 5, and music is played back. At this time, the user can comfortably enjoy high-quality music without excessively turning up the volume even if the surrounding noise is large, because it is canceled and reduced as described above.

Next, in the feedback system of FIG. 10, the microphone

element 1 collect the synthesized sound between the surrounding noise and the sound emitted from the driver unit 2 near the user's ears. And the frequency characteristics (phase and amplitude characteristics) of the equalizer circuit 3 is optimally designed in such a way that the synthesized sound collected by the microphone element 1 becomes below a predetermined level. The gain of AMP 5 is also designed to achieve optimum canceling effects on the surrounding sound.

In the feedback system, as shown in FIG. 10, the adder circuit 4 is mounted on the input side of the equalizer circuit 3. And the music signal, etc. is supplied from the audio signal input terminal 6, added at the adder circuit 4, and supplied to the driver unit 2 via the equalizer circuit 3 and the AMP 5, and the music is played back. In this event, the user can comfortably enjoy the high-quality music without excessively turning up the volume because the surrounding noise is canceled as described above even if it is noisy.

Because the noise canceling headphone has the above-mentioned advantages, it is utilized for listening to the music in the aircraft with engine noises reduced.

However, a conventional noise canceling headphone has a component element for noise canceling, which is structured to be integral with a headphone section in such a way that it is practically inseparable from the headphone section. The reason for the integral structure is that the noise canceling headphone

creates the negative phase component of the noise signal over a broad band exceeding 1 decade and cancels the noise from the viewpoint of the operating principle, but because of large variations of audio characteristics as well as for absorbing the variations of individual noise canceling component elements, all the elements are integrated into one and comprehensively adjusted and corrected to maximize the canceling effects.

However, this kind of integral structure has following problems:

1) Even when part of the component elements, such as ear pads that come in contact with the human body, must be replaced for hygienic reasons, the whole must be replaced;

2) When part of the component elements is replaced, the whole must be adjusted again; and

3) Whether the whole or part is replaced, the maintenance expenses generated in the case become great.

It is an object of the present invention to provide an acoustic apparatus that can clear away the problems as mentioned above.

DISCLOSURE OF THE INVENTION

In order to solve the above-mentioned problems, an acoustic apparatus according to the present invention is characterized by comprising; a headphone section to be mounted to the user head, which has the microphone element for detecting

sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and is equipped with a first output terminal for outputting the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element, and a control circuit section independent from the headphone section, equipped with the second input terminal connected to the first output terminal and the second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal.

Because the headphone section and the control circuit section for generating the signal for canceling the surrounding sound are formed independently, even when part of component elements is replaced, the whole does not need to be replaced. In addition, even if part of the headphone section or control circuit section is replaced, adjustment is required only of the headphone section or control section to which the said partial replacement is carried out, and the adjustment operation becomes

easy and the maintenance expenses can be reduced.

The noise canceling headphone and the acoustic apparatus according to the present invention is characterized in that an adjusting section is provided for adjusting the volume to be canceled of the surrounding sound in the headphone box.

Even when the headphone section and the control circuit section are composed separately, by providing an adjusting section at the headphone section can suitable adjustment be achieved as a noise canceling headphone apparatus.

In addition, the noise canceling headphone and the acoustic apparatus according to the present invention is characterized by frequency characteristics and gain characteristics of the control circuit section being adjusted to predetermined levels at a predetermined frequency within a range of 50 Hz to 1.5 kHz.

Because adjustments are made in the way that the control circuit section itself is nearly free from any variations, even if the two sections are separate, they can be configured to exhibit the predetermined noise canceling effects particularly by combinations.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagram showing the overall configuration example of one embodiment of an acoustic apparatus according to the present invention.

FIG. 2 is a diagram describing an essential portion of one embodiment of an acoustic apparatus according to the present invention.

FIG. 3 is a diagram showing a concrete circuit example of part of the embodiment of FIG. 1.

FIG. 4 is a diagram showing a concrete circuit example of part of the embodiment of FIG. 1.

FIG. 5 is a diagram showing a concrete circuit example of part of the embodiment of FIG. 1.

FIG. 6 is a diagram showing a concrete circuit example of part of the embodiment of FIG. 1.

FIG. 7 is a diagram describing an essential portion of another embodiment of the acoustic apparatus according to the present invention.

FIG. 8 is a diagram showing the overall configuration example of further another embodiment of the acoustic apparatus according to the present invention.

FIG. 9 is a diagram for describing a noise canceling headphone of a feed-forward system .

FIG. 10 is a diagram for describing a noise canceling headphone of a feedback system.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, embodiments of the acoustic apparatus according to the present invention will be described in detail

by referring now to accompanying drawings.

As shown in FIG. 1, an acoustic apparatus of the present embodiment comprises a headphone section 10 and a control circuit section 20. As illustrated, the headphone section 10 and the control circuit section 20 are separately provided, and the headphone section 10 is equipped with a stereo plug 11 as a right and left audio signal output terminal (first output terminal) and a stereo plug 12 as a right and left audio signal input terminal (first input terminal), and the control circuit section 20 is equipped with a jack 21 as a right and left audio signal input terminal (second input terminal) and a jack 22 as a right and left audio signal output terminal (second output terminal) on the side section of the box 23. And inserting the plugs 11, 12 of the headphone section 10 into the jacks 21, 22 of the control circuit section 20 connects the headphone section 10 to the control circuit section 20, and achieves a configuration of the noise canceling headphone later described.

Inside each of the headphone boxes 13L, 13R for right and left ears of the headphone section 10, microphone elements 14L, 14R, driver units 15L, 15R, and gain adjusting sections 16L, 16R are equipped. And the output terminal of microphone elements 14L, 14R are connected to the stereo plug 11 as right and left audio signal output terminals via gain adjusting sections 16L, 16R. The stereo plug 12 as the right and left

audio signal input terminal is connected to the driver units 15L, 15R, respectively.

By the way, the headphone boxes 13L, 13R for right and left ears are connected by a belt 17 composed with the elastic material. As for the parts in contact with the user's ears of the headphone box, ear pads 18L, 18R with cushioning material are equipped. And by the belt 17, the headphone section 10 is able to be mounted to the user head. This is hardly different from general headphones.

The control circuit 20 comprises an equalizer circuit 24, adder circuit 25, and AMP 26, and in the present embodiment, when it is connected to the headphone section 10, a feed-forward system noise-canceling circuit is configured.

To the control circuit section 20, a recording/playback device section 27 is equipped, and the audio signal inputted from the jack 21 is supplied to this recording/playback device section 27 as a recording signal and at the same time, a playback audio signal from this recording/playback device section 27 is supplied to the adder circuit 25. This recording/playback device section 27 may be configured in various ways, such as those with, for example, an optical disk or photo-electro-magnetic disk used for a recording medium, or with a magnetic tape.

That is, in the present embodiment, the control circuit section 20 is configured in such a manner as to have the

equalizer element and the AMP element for the noise canceling headphone device incorporated in a portable type recording/playback device with, for example, the magnetic tape or photo-electro-magnetic disc used for the recording medium.

And as described above, the equalizer circuit 24 has the phase and amplitude characteristics, that is, frequency characteristics, optimally designed in order to obtain the audio signal for canceling the sound around the user of the headphone section 10 in the control circuit section 20. In addition, the AMP 26 is optimally designed so that the gain of the audio signal for canceling the sound around the user becomes optimum. The AMP 26 has a configuration that enables gain adjustment by semi-fixed resistors, etc.

Furthermore, as described above, in order to achieve to absorb the variations of component elements when the noise canceling headphone is divided into the headphone section 10 and the control circuit section 20, the following points are taken into account in the present embodiment.

1) In the case of the present embodiment, as described above, the frequency characteristics of the control circuit section 20 is optimized in order to effectively cancel the surrounding sound, and parts with ±5% or ±2% tolerances are used for the control circuit section 20 so that the variations of characteristics of the control circuit section 20 become minimum.

2) As shown in FIG. 2, the overall gain errors of the equalizer circuit 24 to AMP 26 of the control circuit section 20 are adjusted to be within ±0.2 dB at the position of 300 Hz of the frequency in this example. This adjusted frequency is an example, and a predetermined frequency is chosen between 50 Hz and 1.5 kHz, and preferably between 100 Hz and 1 kHz. This is a band in which noise cancellation is effectively carried out.

3) To jacks 21, 22 of the control circuit section 20 after adjustments, plugs 11, 12 of the headphone section 10 are inserted and connected to connect the headphone section 10 to the control circuit section 20, and, for example, semi-fixed resistors of adjusting sections 16L, 16R of the headphone section 10 are adjusted to vary gains and are set to a condition in which the volume to be canceled is maximized.

As described above, in the present embodiment, in the control circuit section 20, the absolute error of component parts is controlled to be as small as possible, and the error at the headphone section 10 is adjusted one by one by the adjustment elements incorporated into this headphone section, and even when the noise canceling headphone is separated into the headphone section 10 and the control circuit section 20, an acoustic apparatus that is nearly free from variations and that can provide satisfactory canceling effects of surrounding sound is able to be comprehensively achieved.

That is, under the condition in which the headphone

section 10 is connected to the control circuit section 20, the audio signal corresponding to the surrounding sound collected by microphone elements 14L, 14R is inputted into the equalizer circuit 24 of the control circuit section 20 through the adjusting sections 16L, 16R, and is controlled in such a manner that the phase and amplitude characteristics become optimum as the audio signal for canceling the surrounding sound. And the output signal of this equalizer circuit 24 is supplied to the AMP 26 through the adder circuit 25, and is made into the optimum gain as an audio signal for canceling the surrounding sound.

The audio signal from the AMP 26 for canceling the sound around the above-described user is supplied to driver units 15L, 15R of the headphone section 10. That is, the driver units 15L, 15R function as sound sources for canceling the sound around the user.

In this way, the sound of a negative phase to that of the surroundings is emitted near the ear (eardrum) of the user, and this is acoustically synthesized with surrounding sound. As a result, the surrounding sound is canceled, and the user is able to hear the sound with surrounding sound reduced.

In this case, music signals, etc. are supplied from the recording/playback device section 27, added at the adder circuit 25, and supplied to the driver units 15L, 15R through the AMP 26, and music is played back. The playback sound the user hear

in this case is a clear playback sound with surrounding noise alleviated.

In the present embodiment, so-called binaural recording with superb presence becomes possible with the recording/ playback device section 27. That is, microphone elements 14L, 14R are mounted to headphone boxes 13L, 13R, and are able to collect sounds extremely close to those the user hear by its ears. Consequently, recording and playing back the sound collected with the microphone elements 14L, 14R by the recording/playback device section 27 enables the playback of the sound extremely close to the sound the user hear by its ears, and the playback sound with superb presence is able to be obtained.

The reason why this kind of binaural recording is made possible is that the headphone section 10 and the control circuit section 20 are made independent, and the stereo plug 11 is equipped as an output terminal of the audio signal of the sound collected by the microphone elements 14L, 14R.

And in the present embodiment, it becomes possible to simultaneously monitor the audio signal from the microphone elements 14L, 14R at the driver units 15L, 15R while it is being recorded at the recording/playback device section 27.

Next description will be made of specific configuration examples of varying gains at adjusting sections 16L, 16R.

The example of FIG. 3 is the case of the adjusting

section 16L, in which the audio signal obtained by acoustic-electric signal conversion at the microphone element 14L is amplified at the FET AMP 31 and taken out, and a semi-fixed resistor 32 is installed in series to this audio signal. By adjusting the resistance value of the semi-fixed resistor 32, gains are adjusted.

The example of FIG. 4 is similarly the case of the adjusting section 16L, in which a capacitor 33 and a semi-fixed resistor 34 are connected between drain and source of the FET AMP 31. In the case of this example, too, by adjusting the resistance of the semi-fixed resistor 34, gains are adjusted.

The gain adjusting section is able to be installed on the driver unit 15L, 15R side. FIG. 5 and FIG. 6 show configuration examples in such a case, and examples of driver unit 15L side.

That is, FIG. 5 shows a series type and FIG. 6 a parallel type. That is, in the example of FIG. 5, a semi-fixed resistor 35 is connected in series to the driving coil of the diaphragm of the driver unit 15L. In the example of FIG. 6, the resistance connected in parallel to the driving coil of the diaphragm of the driver unit 15L is configured in such a manner as to be adjusted by the semi-fixed resistor 36.

Examples of the adjusting section of FIG. 3 through FIG. 6 are all configured to adjust gains for every headphone section 10 by the use of the semi-fixed resistor at the time of

manufacture, but it is allowed to configure to enable the user to carry out further adjustment at the time of use.

FIG. 7 shows a configuration example of the headphone box 13L part on the right ear side of the headphone section in that case. As illustrated, in the case of this example, to the headphone box 13L, an adjusting knob 40 of the adjusting section which the user can operate and adjust is installed.

And in the case of this example, semi-fixed resistors 32, 34, 35, 36 of FIG. 3 through FIG. 6 are recommended to have a configuration to divide the semi-fixed resistor part and a variable resistor part which can be adjusted with the adjusting knob 40. That is, the degree that can achieve the predetermined surrounding noise canceling effects is secured by adjusting the semi-fixed resistor part. And by the adjustment by the user using the adjusting knob 40, the canceling effects are further improved. In the case of this example, the adjustable range by the user is narrow, but even if this is not adjusted, the predetermined noise canceling effects are able to be achieved by the adjustment by the semi-fixed resistor.

In other words, adjusting the semi-fixed resistor can achieve adjustment to the degree in which a certain satisfactory level of canceling effects are obtained, but variations of canceling performance associated with inherent attributes such as the profile of user auricle is unable to be compensated for. However, according to this example, the variation portion which

is unable to be compensated for is able to be collected by the user operating and adjusting the adjusting knob 40.

As described above, since in the above-mentioned embodiment, the headphone section 10 and the control circuit section 20 are able to be separated, following various advantages are able to be achieved.

The reliability of the headphone section 10 is improved. In other words, the failure rate is expected to lower. Even when one-to-plurality combination is carried out, in which one piece of control circuit section 20 is combined with plural numbers of headphone sections 10, satisfactory cancellation effects as required are able to be obtained.

The cost of the headphone section 10 is able to be minimized, and the replacement cost is able to be reduced at the time of replacing the headphone section due to breakage, etc.

A signal output of the microphone element is able to be utilized and binaural recording is easily achieved. In addition, simultaneous monitoring while the signal output of the microphone element is being recording is possible.

By enabling the user to adjust and operate the whole or a part of the adjusting section of the headphone section with an adjusting knob, the volume to be canceled is able to be varied, and the user is able to adjust to the optimum cancel point.

The above-mentioned examples are cases in which the control circuit section 20 is a recording/playback device, but

needless to say, the control circuit section 20 may have a configuration wherein a device is equipped with an equalizer element for the noise canceling headphone and AMP element without possess the recording/playback functions. The device not equipped with the recording/playback functions is useful as a device used, for example, in a cabin of aircraft. In the case of device configuration for the aircraft cabin, to the adder circuit 25 of the control circuit section 20, audio sources such as music programs prepared in advance are supplied.

The control circuit section 20 may have a configuration of a remote controller of a portable type recording/playback device. FIG. 8 shows the external configuration diagram in that case.

That is, in the example of FIG. 8, plugs 11 and 12 of the headphone section 10 are connected to jacks installed in the remote controller 50, respectively. Inside the remote controller 50, the equalizer circuit 24, adder circuit 25, and circuit part of AMP 26 of the control circuit section 20 in FIG. 1 are mounted, and in the case of this example, a configuration of a noise canceling headphone device is realized by the headphone section 10 and the remote controller 50.

And this remote controller 50 is equipped with a plug 51 plurally connected to the remote control terminal and headphone terminal of the recording/playback device 60 in order to provide functions for remotely controlling the recording/playback device

60 as well as functions to receive playback signals from the recording/playback device 60 and supply them to the adder circuit 25.

In addition, the remote controller 50 of this example is equipped with a plug 52 for being inserted into a jack as an audio signal input terminal of the recording/playback device 60, and has a function to supply audio signals from microphone elements 14L, 14R of the headphone section 10 to the audio signal input terminal of the recording/playback device 60. With these functions, in the recording/playback device 60, binaural recording becomes possible, and simultaneous monitoring in that case is also possible.

In the above-mentioned embodiments, description is made of the feed-forward system for the noise canceling system, but in the present invention, it is needless to say that the same configuration is able to be achieved whether the feedback system is used for the noise canceling system or digital system noise canceling system is used.

POSSIBILITY FOR INDUSTRIAL USE

This invention is applied to the so-called noise canceling headphone for collecting noise around the user by the microphone with a headphone built into a box, analyzing the noise, outputting the sound of a negative phase to the noise, and reducing the surrounding noise. In this case, the noise

canceling headphone is utilized in the aircraft for listening to music with engine noise reduced.

CLAIMS

1. An acoustic apparatus comprising:

a headphone section to be mounted on the user head, having the microphone element for detecting a sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and equipped with a first output terminal for outputting the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element, and

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal.

2. An acoustic apparatus according to claim 1, wherein the control circuit section is equipped with a recording means

for recording the audio signal from the microphone element.

3. An acoustic apparatus according to claim 1, wherein the control circuit section is equipped with means for adding different audio signals to the canceling audio signals by using the signal audio converter element as a sound source in order to cancel the surrounding sound.

4. An acoustic apparatus according to claim 1, wherein the control circuit section comprises a means for adding different audio signals to the canceling audio signals by using the signal audio converter element as a sound source in order to cancel the surrounding sound, and

a remote control equipment is configured so as to supply remote-control signals for remotely controlling the output device of the different audio signals to the output device of the audio signals.

5. An acoustic apparatus comprising:

a headphone section to be mounted to the user head, having the microphone element for detecting sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and equipped with a first output terminal equipped with an adjusting section for adjusting the output of

the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element, and

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal.

6. An acoustic apparatus according to claim 5, wherein an amplifier section is equipped in the headphone box behind the adjusting means for generating the output signal from the microphone element serving as a sound source in order to cancel the sound around the user and for adjusting the output signal from the microphone element, and gains are controlled by amplifying the output signals.

7. An acoustic apparatus according to claim 5, wherein an amplifier section for generating signals serving as a sound

source for canceling the sound around the user and an adjusting means for adjusting the output level of the amplifier section are provided in the headphone box, and gains of signals inputted to the signal acoustic transducing element are controlled.

8. An acoustic apparatus according to claim 5, wherein an adjusting section generates output signals from the microphone element that serves as an sound source for canceling the sound around the user and adjusts the output signal from the microphone element in the headphone box,

said adjusting means having an operating means which the user is able to operate from the outside, and

an amplifier section for amplifying the output signals adjusted at the adjusting section.

9. an acoustic apparatus according to the present invention comprising

a headphone section to be mounted to the user head, having the microphone element for detecting sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and equipped with a first output terminal for outputting the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element, and

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, the said frequency characteristics and gain characteristics being adjusted to achieve the predetermined ones in the predetermined frequency between 50 Hz and 1.5 kHz, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal.

10. An acoustic apparatus according to the present invention comprises

a headphone section to be mounted to the user head, having the microphone element for detecting sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and equipped with a first output terminal for outputting the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element,

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal, and

a control circuit section in which the circuit configuration for canceling the surrounding sound is of a feed-forward system.

11. An acoustic apparatus according to the present invention comprises

a headphone section to be mounted to the user head, having the microphone element for detecting sound around the user and a signal acoustic transducing element with a function as a sound source for canceling the sound around the user housed in a headphone box, and equipped with a first output terminal for outputting the audio signal collected by the microphone element and a first input terminal for inputting the audio signal supplied to the signal acoustic transducing element,

a control circuit section independent from the headphone section, equipped with a second input terminal connected to the first output terminal and a second output terminal connected to the first input terminal, and intended to control at least the frequency characteristics and the gain characteristics of the audio signal from the microphone element of the headphone section inputted through the second input terminal, to generate a signal that can serve as a sound source for canceling the surrounding sound, and to supply the signal to the signal acoustic transducing element of the headphone section through the second output terminal, and

a control circuit section in which the circuit configuration for canceling the surrounding sound is of a feedback system.

12. A headphone comprising:

a box for housing a microphone element for detecting the sound around the user and a signal acoustic transducing element equipped with a function as a sound source for canceling the sound around the user,

an output terminal of the audio signal whose sound is collected by the microphone element, and an input terminal for audio signals supplied to the signal acoustic transducing element.

13. A headphone comprising:

a box for housing a microphone element for detecting the sound around the user, a signal acoustic transducing element equipped with a function as a sound source for canceling the sound around the user, and an adjusting section for adjusting the cancel amount of the surrounding sound,

an output terminal of the audio signal whose sound is collected by the microphone element, and an input terminal for audio signals supplied to the signal acoustic transducing element.

14. A headphone according to claim 13, wherein the adjusting section comprises a means for adjusting gains to output signals from the microphone element.

15. A headphone according to claim 13, wherein the adjusting section comprises a means for adjusting gains to the signal inputted to the signal acoustic transducing element.

ABSTRACT OF THE DISCLOSURE

A headphone section 10 having microphone elements 14L, 14R for detecting a sound around the user and signal acoustic transducing elements 15L, 15R with a function as a sound source for canceling the sound around the user housed in the headphone boxes 13L, 13R and a control circuit section 20 that comprises a noise canceling headphone together with the headphone section 10 are separately configured. The control circuit section 20 is adjusted in such a manner that variation can be reduced and predetermined frequency characteristics and gain characteristics are achieved at a predetermined frequency. To the headphone section 10, gain adjusting sections 16L, 16R are equipped.

FIG. 1

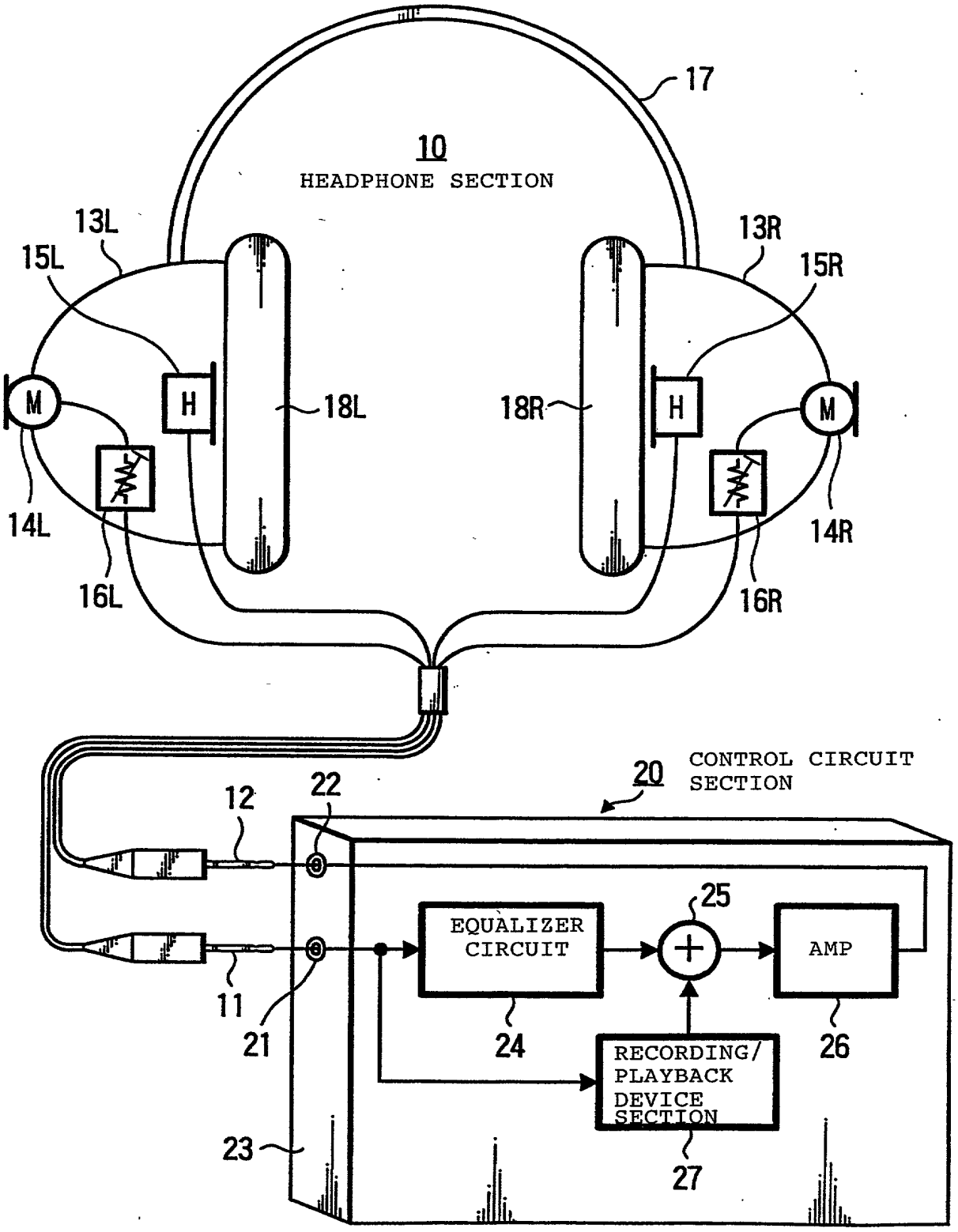

17
10
HEADPHONE SECTION
13L
15L
13R
15R
M
H
18L
18R
H
M
14L
14R
16L
16R
20
CONTROL CIRCUIT SECTION
12
22
25
EQUALIZER CIRCUIT
AMP
11
21
24
26
RECORDING/ PLAYBACK DEVICE SECTION
23
27

FIG. 2

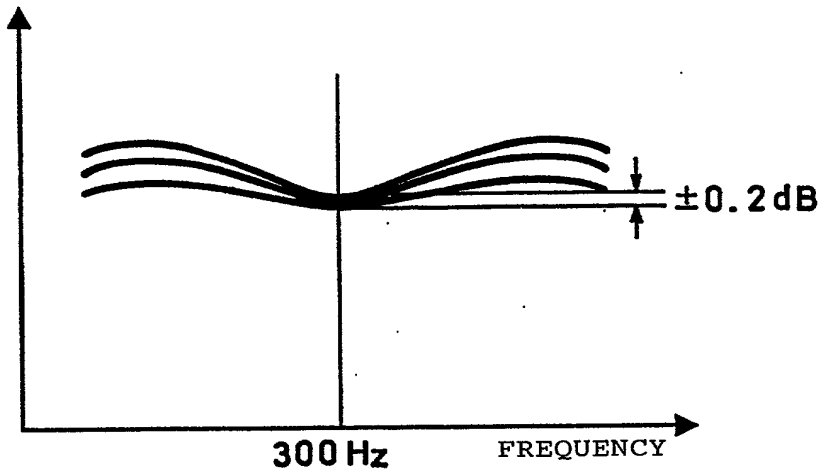


FIG. 3

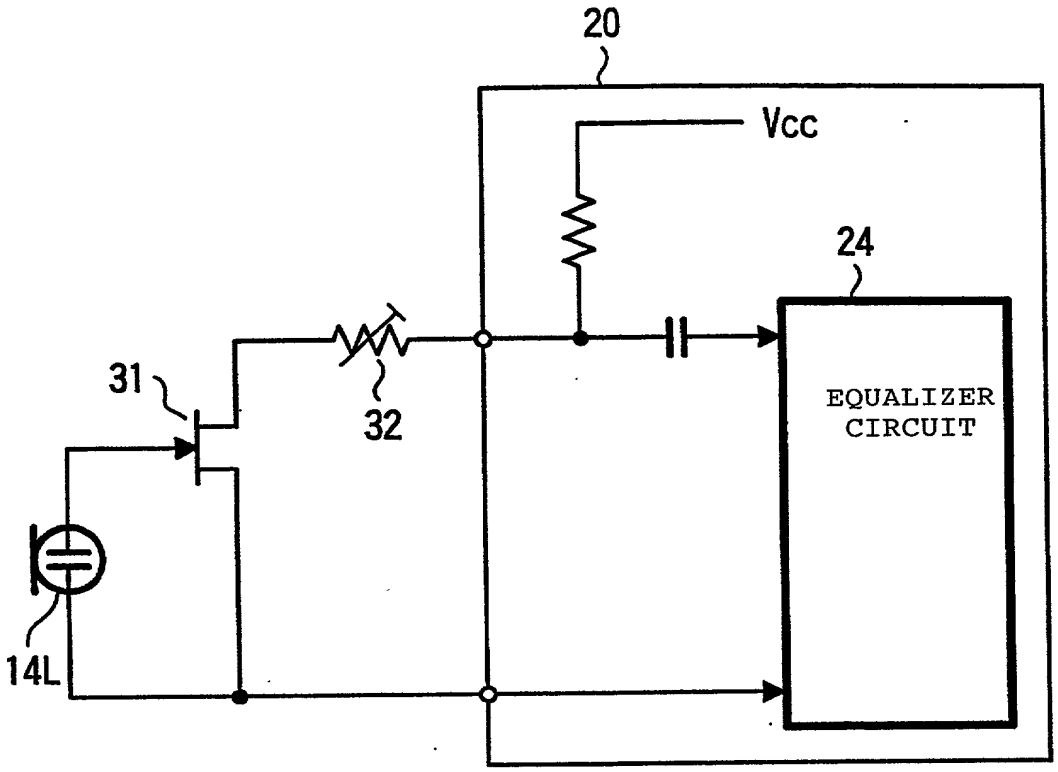

20
Vcc
24
31
32
EQUALIZER CIRCUIT
14L

FIG. 4

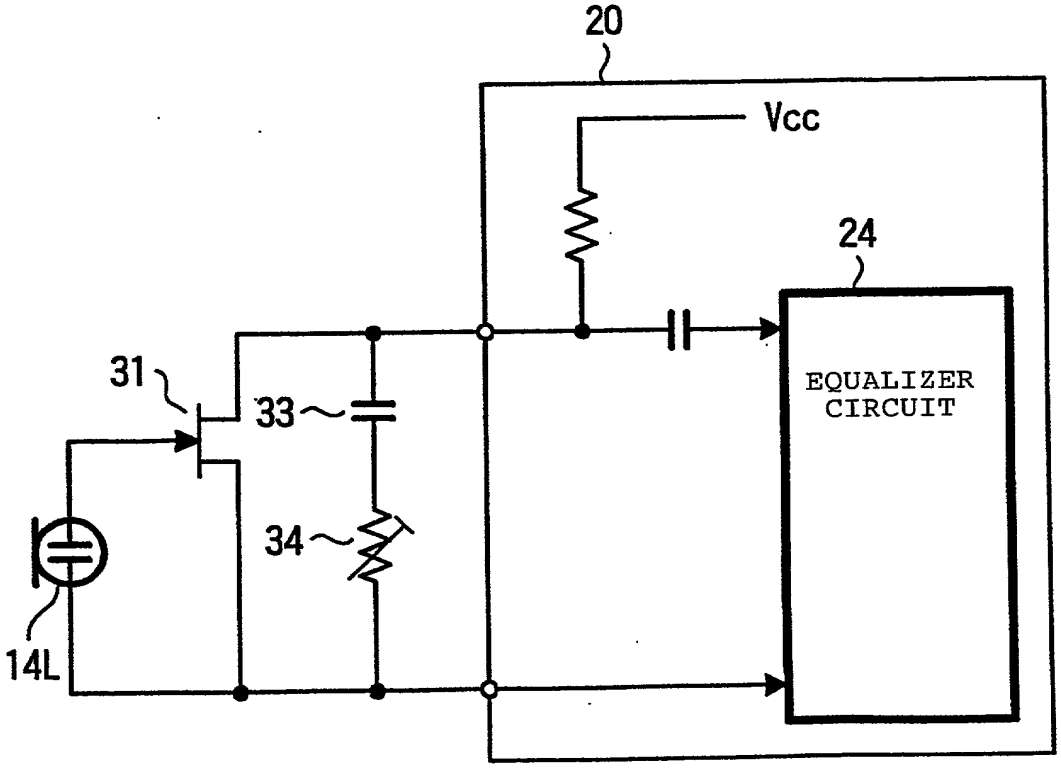

20
Vcc
24
31
33
34
EQUALIZER CIRCUIT
14L

FIG. 5

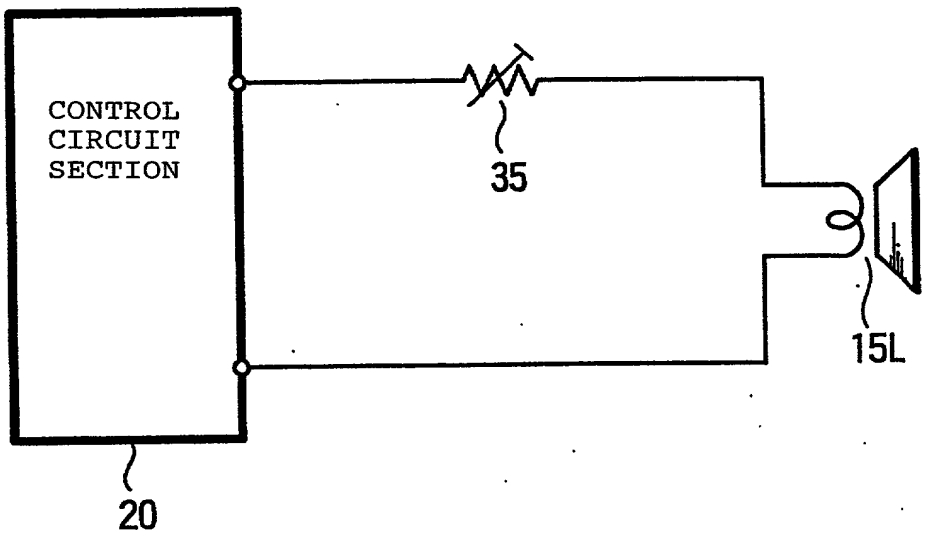

CONTROL
CIRCUIT
SECTION
35
15L
20

FIG. 6

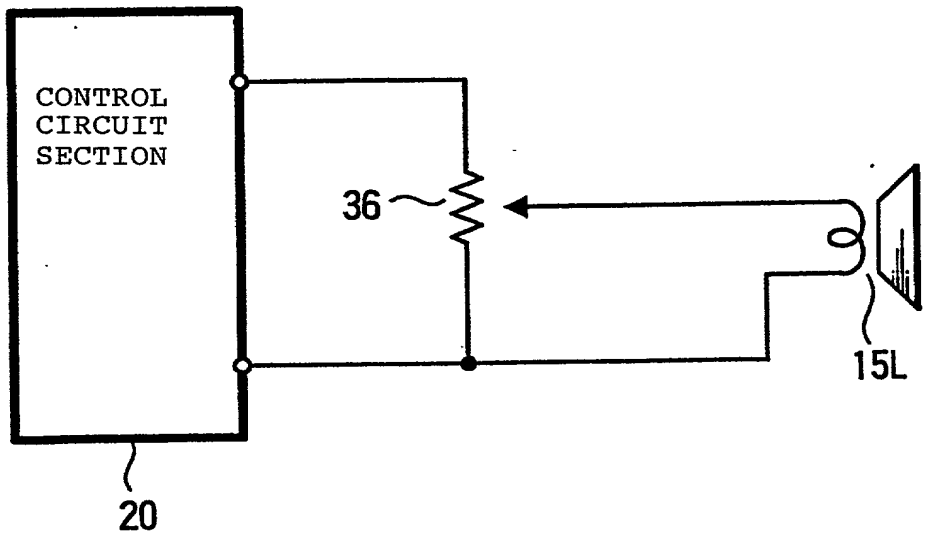

CONTROL
CIRCUIT
SECTION
36
15L
20

FIG. 7

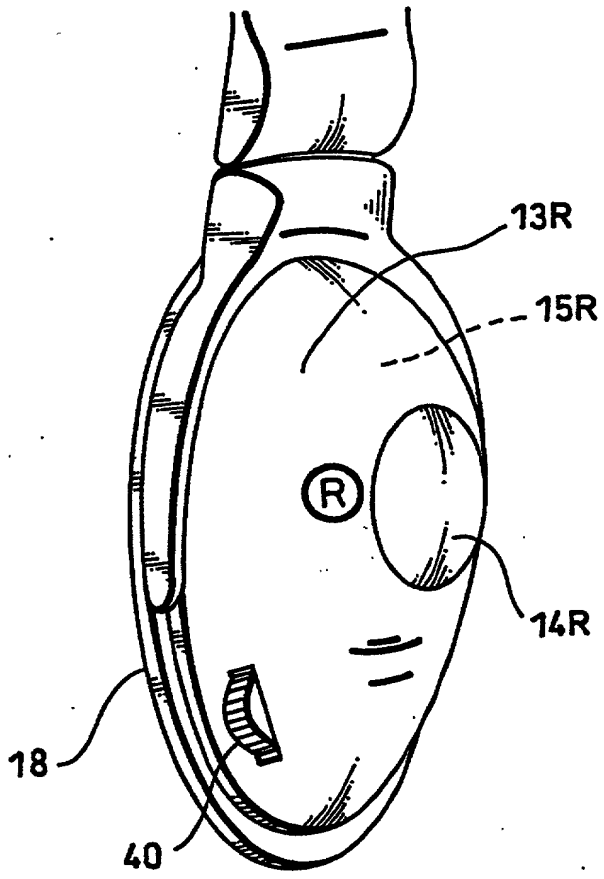


FIG. 8

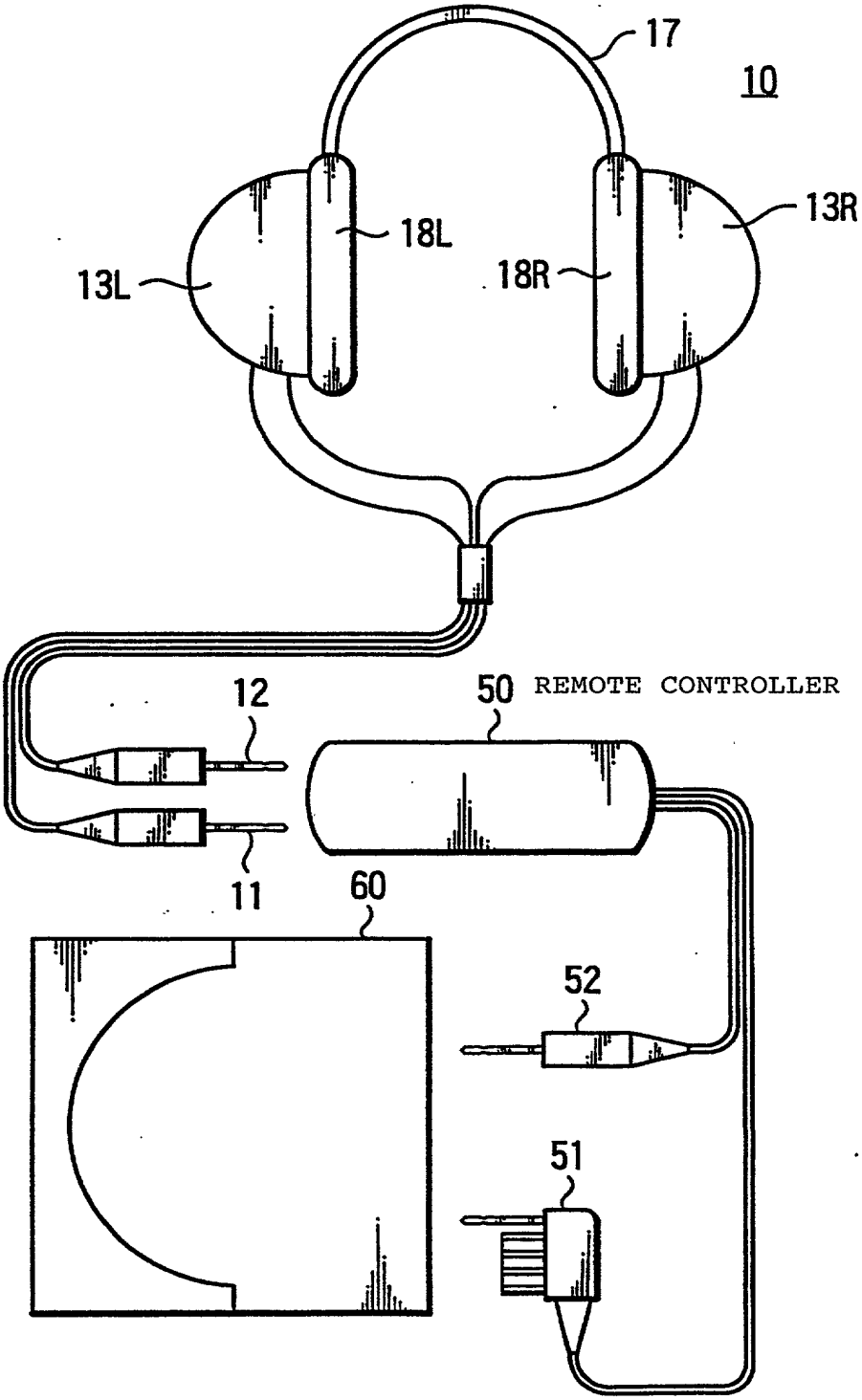


FIG. 9

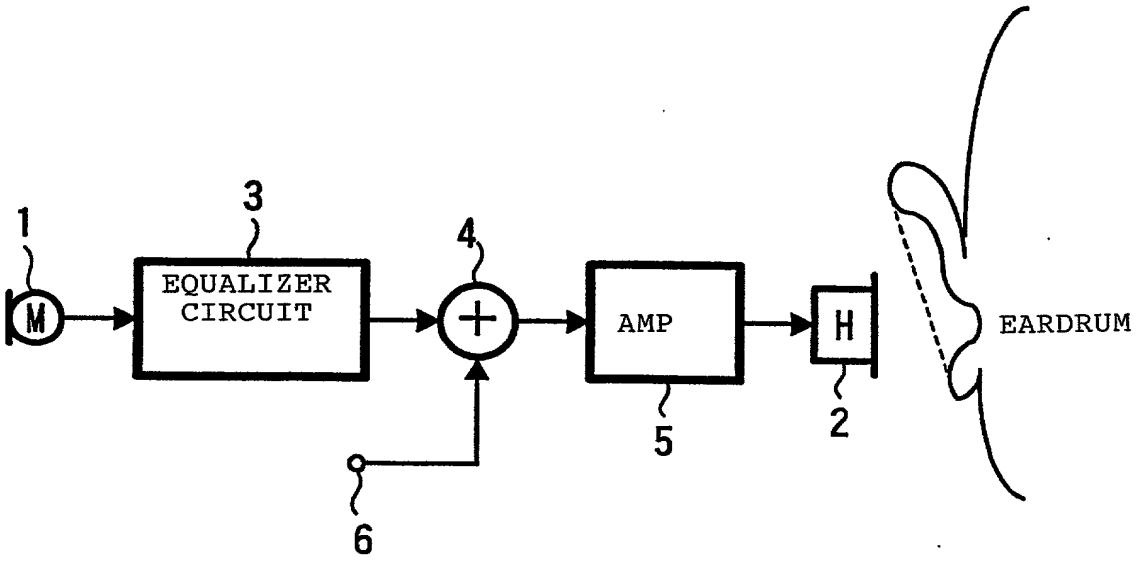
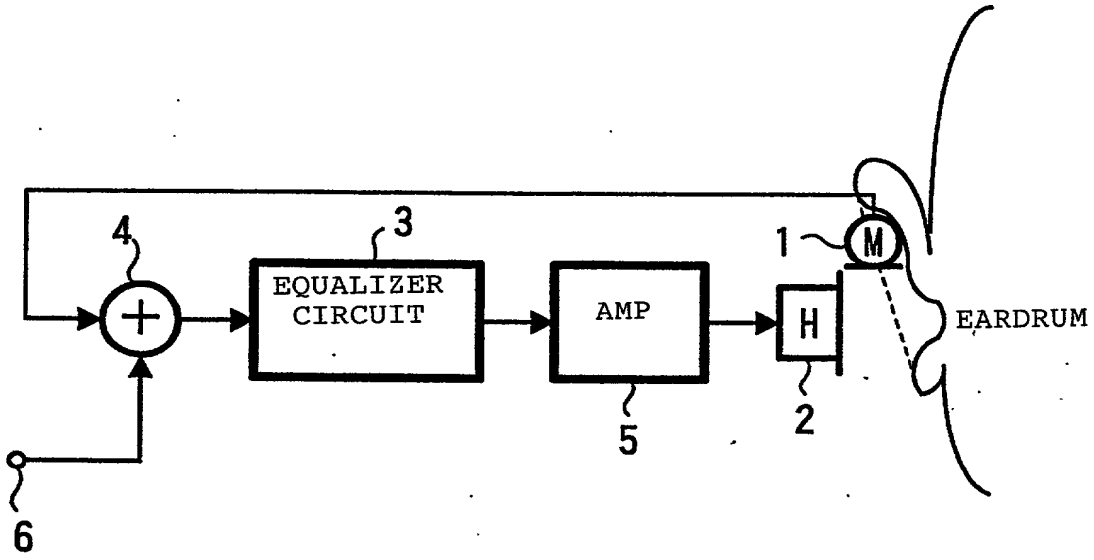

1
3
4
EQUALIZER CIRCUIT
M
AMP
H
EARDRUM
5
2
6

FIG. 10


4
3
1
M
EQUALIZER CIRCUIT
AMP
H
EARDRUM
5
2
6

DESCRIPTION OF REFERENCE NUMERALS

10 ... HEADPHONE SECTION

11 ... PLUG (FIRST OUTPUT TERMINAL)

12 ... PLUG (FIRST INPUT TERMINAL)

13L, 13R ... HEADPHONE BOXES

14L, 14R ... MICROPHONE ELEMENTS

15L, 15R ... DIVER UNITS

16L, 16R ... GAIN ADJUSTING SECTION

20 ... CONTROL CIRCUIT SECTION

21 ... JACK (SECOND INPUT TERMINAL)

22 ... JACK (SECOND OUTPUT TERMINAL)

24 ... EQUALIZER CIRCUIT

25 ... ADDER CIRCUIT

26 ... AMP

27 ... RECORDING/PLAYBACK DEVICE SECTION

40 ... ADJUSTING KNOW

50 ... REMOTE CONTROLLER

60 ... RECORDING PLAYBACK DEVICE

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6640/59442

DECLARATION AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ACOUSTIC APPARATUS AND HEADPHONE

the specification of which
(check one)

___ is attached hereto.

_X_ was filed on August 12, 1999(International Filing Date) as

International Application No. PCT/JP99/04377

corresponding to U.S. Serial No. 09/529,269

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information of which I am aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
Number	Country	Filing Date	Yes	No
P10-228759	Japan	August 13, 1998	X	___

S99P0913US00

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States Application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:Declaration and Power of Attorney

Application Serial No.	Filing Date	Status

And I hereby appoint Jay H. Maioli, Reg. No. 27,213; Donald S. Dowden, Reg. No. 20,701; William E. Pelton, Reg. No. 25,702; Peter J. Phillips, Reg. No. 29,691; Ivan S. Kavrukov, Reg. No. 25,161; Christopher C. Dunham, Reg. No. 22,031; Norman H. Zivin, Reg. No. 25,385; John P. White, Reg. No. 28,678; and Robert D. Katz, Reg. No. 30,141; and each and all of them, all c/o Cooper & Dunham, 1185 Avenue of the Americas, New York, NY 10036 (Tel. (212) 278-0400), my attorneys, each with full power of substitution and revocation, to receive the patent, to transact all business in the Patent and Trademark Office connected therewith and to file any International Applications which are based thereon under the provisions of the Patent Cooperation Treaty.

Please address all communications, and direct all telephone calls, regarding this application to

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New York, New York 10036
Tel. (212) 278-0400

Reg. No. 27,213

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's signature Kensaku Abe

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